Annual Progress Report on Agricultural Operations' Stage 1 Reductions
Falls Reservoir Water Supply Nutrient Strategy: Agriculture
(15 A NCAC 02B.0280)
For the Baseline Period (2006) through Crop Year 2012
A Report to the Water Quality Committee of the Environmental Management Commission
From the Falls Lake Watershed Oversight Committee

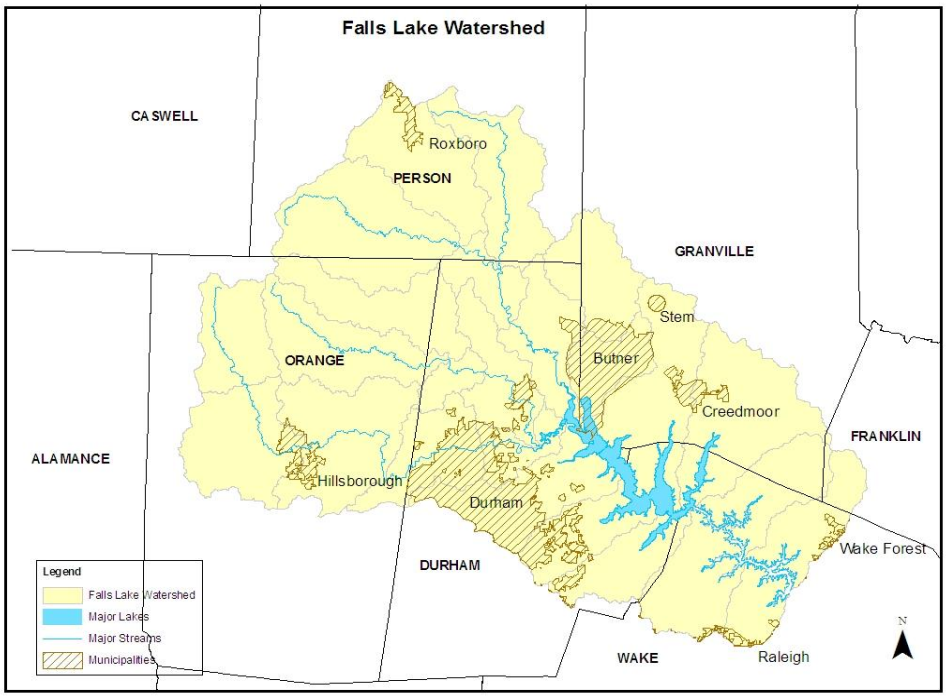
SUMMARY

This report provides the annual progress report of collective progress made by the agricultural community to reduce nutrient losses toward compliance with Stage 1 of the Falls Lake Agriculture rule. For this report, the Falls Lake Watershed Oversight Committee (WOC) oversaw the application of accounting methods approved by the Water Quality Committee in March 2012 to estimate changes in nitrogen loss and phosphorus loss trend in the Falls Lake Watershed for the period between the strategy baseline (2006) and the most recent crop year (CY) for which data was available, 2012. The Falls Lake Watershed Oversight Committee (WOC) received and approved crop year CY2012 annual reports from six counties as part of the Falls Lake Agriculture rule, which is part of the Falls Reservoir Water Supply Nutrient Strategy. To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and current-year reports from agricultural staff in six counties, and the WOC compiled the information and prepared this report. Agriculture has been successfully decreasing nutrient losses in the Falls Lake watershed. In CY2012, agriculture collectively exceeded its 20% Stage I nitrogen reduction goal, with a 31% reduction compared to the 2006 baseline. This percentage remains the same as the reduction reported for CY2011. All six of the counties exceeded the mandated 20% reduction goal this year. Reductions in nitrogen have been achieved through an overall decrease in cropland in production, a decrease in nitrogen application rates, and an increase in best management practices (BMPs) such as 20 and 50-foot riparian buffers. Since the baseline cropland decreased in the watershed by 10,837 acres. Of the agricultural land, 2,560 acres was lost to development. Phosphorus qualitative indicators demonstrate that there is no increased risk of phosphorus loss, with an 8% and 14% decrease in animal waste phosphorus production and tobacco acreage, respectively, and an increase in cropland conversion to grass and trees since the 2006 baseline.

Falls Lake Watershed Oversight Committee Composition, Falls Agriculture Rule:

1. NC Division of Soil & Water Conservation
2. USDA-NRCS
3. NCDA&CS
4. NC Cooperative Extension Service
5. NC Division of Water Resources
6. Watershed Environmental Interest
7. Watershed Environmental Interest
8. Environmental Interest
9. General Farming Interest
10. Pasture-based Livestock Interest
11. Equine Livestock Interest
12. Cropland Farming Interest
13. Scientific Community

Figure 1. Map of Falls Lake Watershed



BACKGROUND

Rule requirements and compliance

In January 2011, the permanent Agriculture Rule that is part of the Falls Reservoir Water Supply Nutrient Strategy became effective. The Agriculture Rule provides for a collective strategy for farmers to meet nitrogen loss reduction goals in two stages. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. Stage 1 requires that agriculture reach a goal of 20% nitrogen loss reduction and 40% phosphorus reduction by year 2020. Stage II sets reduction goals of 40% and 77% for nitrogen and phosphorus, respectively, by year 2035. A Watershed Oversight Committee (WOC) was established to implement the rule and to assist farmers with complying with the rule.

Falls Lake NSW Strategy:

The Environmental Management Commission (EMC) adopted the Falls Reservoir Water Supply Nutrient Strategy rules in 2011. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. In addition to point source rules, mandatory controls were applied to addressing non-point source pollution in agriculture, urban stormwater, and riparian buffer protection. The management strategy was built upon the Neuse River, Tar-Pamlico River, and Jordan Lake Strategies.

All county Local Advisory Committees (LAC) submitted their second annual reports to the WOC in December 2013. Collectively, agriculture in the six counties is meeting the nitrogen loss reduction goal, with a 31% reduction. Phosphorus qualitative indicators for phosphorus suggest there is no increased risk of phosphorus loss from agriculture in the watershed.

Scope of Report and Methodology

The estimates provided in this report represent whole-county scale calculations of nitrogen loss from cropland agriculture in the watershed made by soil and water conservation district technicians using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet, or NLEW. The NLEW is an accounting tool developed to meet the specifications of the Neuse Rule and approved by the Environmental Management Commission's (EMC) Water Quality Committee in March 2012 for use in the Falls Lake Watershed. The development team included interagency technical representatives of the NC Division of Water Quality (DWQ), NC Division of Soil and Water Conservation (DSWC), United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) and was led by NC State University (NCSU) Soil Science Department faculty. The NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland. It does not capture the effects of nitrogen applied to pastureland, and is an "edge-of-management unit" accounting tool; it estimates changes in nitrogen loss from croplands, but does not estimate changes in nitrogen loading to surface waters. Assessment methods were developed and approved by the Water Quality Committee of the EMC for pastureland and phosphorus, and are described later in the report.

NITROGEN LOSS ACCOUNTING

Nitrogen Reduction from Cropland from 2006 Baseline for CY2012

All counties submitted their second progress reports to the WOC in December 2013. In CY2012 agriculture achieved a 31% reduction in nitrogen loss compared to the average 2006 baseline. All of the counties individually surpassed the Stage 1 20% reduction goal for nitrogen in the Falls Lake watershed. Table 1 lists each county's baseline, CY2011 and CY2012 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions from the baseline in CY2011 and CY2012.

Table 1. Estimated reductions in agricultural nitrogen loss (cropland) from baseline (2006) for CY2011, CY2012, Falls Lake Watershed

County	Baseline N Loss (lb)* NLEW v. 5.33b	CY2011 N Loss (lb)* NLEW v. 5.33b	CY2011 N Reduction(%)	CY2012 N Loss (lb)* NLEW v. 5.33b	CY2012 N Reduction (%)
Durham	135,902	98,354	28%	104,557	23%
Franklin	11,717	6,953	41%	5,080	57%
Granville	127,704	81,252	36%	101,675	20%
Orange	347,402	258,165	26%	276,838	20%
Person	484,123	303,985	37%	267,950	45%
Wake	49,932	45,232	9%	39,537	21%
Total	1,156,780	793,941	31%	795,637	31%

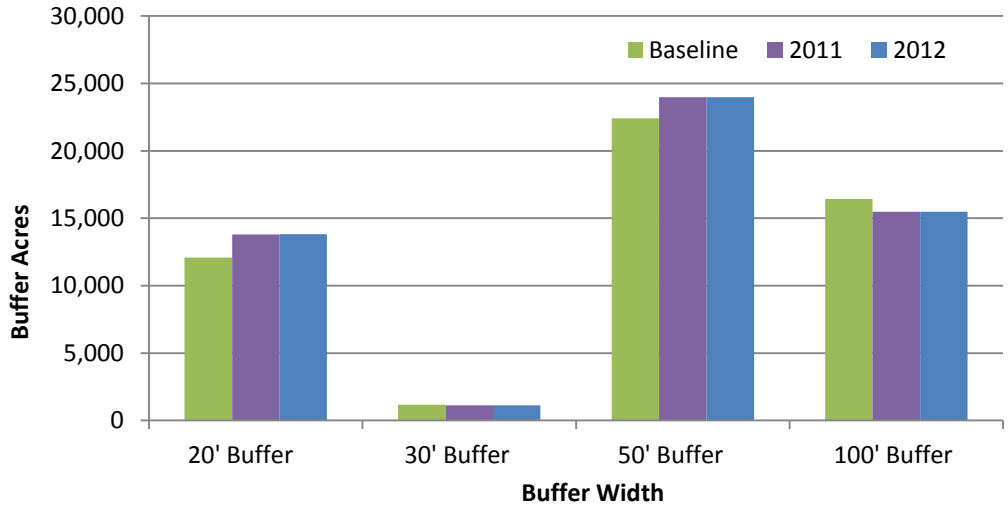
**Nitrogen loss values are for comparative purposes. They represent nitrogen that was applied to cropland in the watershed and neither used by crops nor intercepted by BMPs in an agricultural management unit, based on NLEW calculations. This is not an in-stream loading value.*

Best Management Practice Implementation

Agriculture is credited with different nitrogen reduction efficiencies, expressed as percentages, for riparian buffer widths ranging from 20 feet to 100 feet. The NLEW version 5.33b for Neuse River Basin provides the following percent nitrogen reduction efficiencies for buffer widths on cropland: 20' receives 20% reduction, 30' receives 25% reduction, 50' receives 30%, and 100' receives 35% reduction. Note that these percentages represent the net or relative percent improvement in nitrogen removal resulting from riparian buffer implementation.

Figure 2 illustrates the amount of buffers on cropland in the baseline (2006) and CY2012. Overall, total acres of buffers have slightly increased since the baseline (4.4%). Acres of buffers of 20 and 50 foot widths have increased, while 30 and 100 foot buffers have remained unchanged. The reported buffer acres do not take into account the entire drainage area treated by buffers in the piedmont which is generally 5 to 10 times greater than the actual acres of the buffers shown in Figure 2 (Bruton 2004)[1]. Riparian buffers have many important functions beyond being effective in reducing nitrogen. Recent research has shown that upwards of 75% of sediment from agricultural sources is from stream banks and that riparian buffers, particularly trees, are important for reducing this sediment[2] (Osmond et al 2012). In addition, riparian buffers can reduce phosphorus and sediment as they move through the buffer and provide other critically important functions such as wildlife habitat and stream shading.

Figure 2. Nitrogen Reducing Buffers installed on Croplands from Baseline (2006) through CY2012, Falls Lake Watershed*



** The acres displayed represent buffer acres. Acres treated by the buffer could be 5 to 10 times larger in the piedmont than the actual buffer acreage shown above. (Bruton 2004)[1]*

[1] Bruton, Jeffrey Griffin. 2004. Headwater Catchments: Estimating Surface Drainage Extent Across North Carolina and Correlations Between Landuse, Near Stream, and Water Quality Indicators in the Piedmont Physiographic Region. Ph.D. Dissertation. Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27606.

[2] Osmond, D., D. Meals, D. Hoag, and M. Arabi. 2012. How to Build Better Agricultural Conservation Programs to Protect Water Quality: The NIFA-CEAP Experience. Soil and Water Conservation Society, Ankeny, IA.

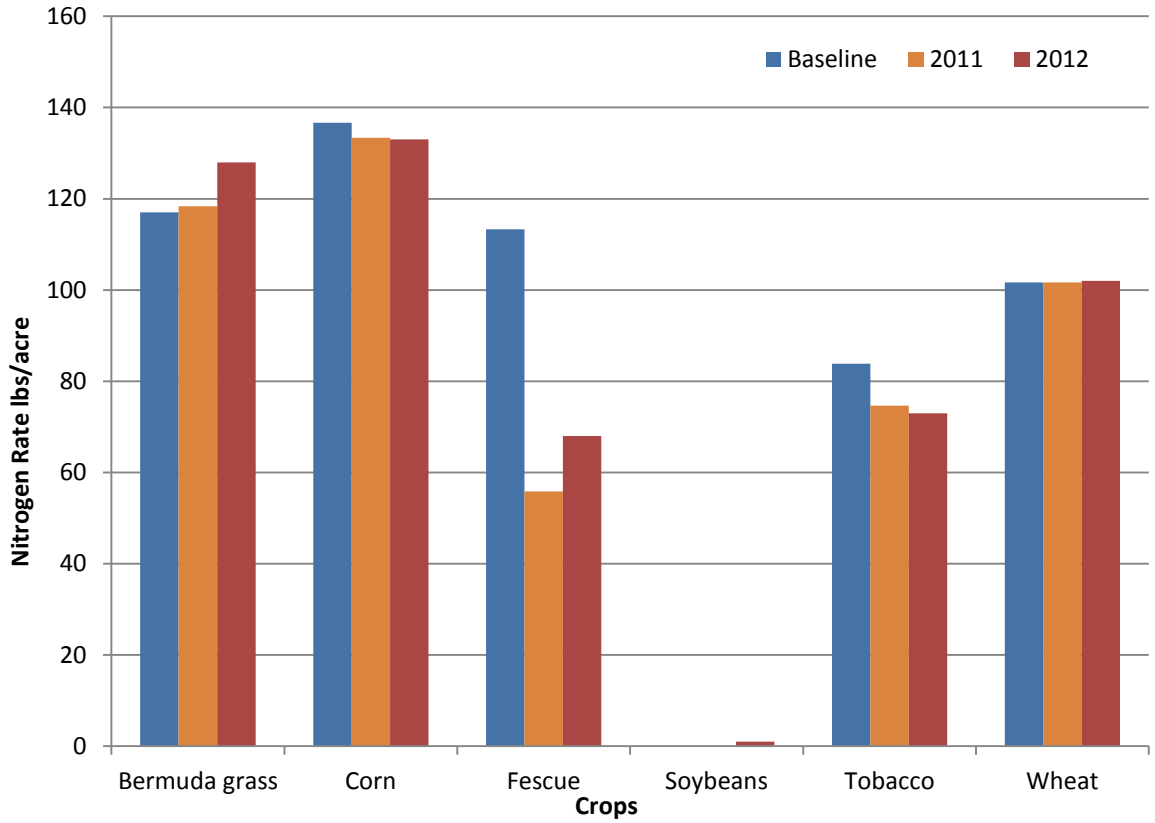
Fertilization Management

Increased fertilizer cost has impacted the application rates of nitrogen on farms in the Falls Lake Watershed. For most crops, farmers have reduced their nitrogen application rates from baseline levels. Figure 3 displays the nitrogen application rates in pounds per acre for the major crops in the watershed. Nitrogen application rates for fescue hay are still 45 pounds/acre lower than during the baseline, despite an increase in application rates from CY2011. The decrease since the baseline is due to increasing fertilizer costs and decreasing profits from beef cattle. Rates on bermuda grass increased, while rates on tobacco decreased slightly. Corn, soybeans and wheat nitrogen application rates remained relatively constant in CY2012 compared to the 2006 baseline. Fertilizer rates will be revisited annually by county local advisory committees using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Factors Identified by LACs Contributing to Reduced Nitrogen Application Rates since the Baseline Year:

- Rising fertilizer costs and fluctuating farm incomes.
- Mandatory waste management plans.
- The federal government tobacco quota buy-out reducing tobacco acreage.
- Neuse Nitrogen Strategies.

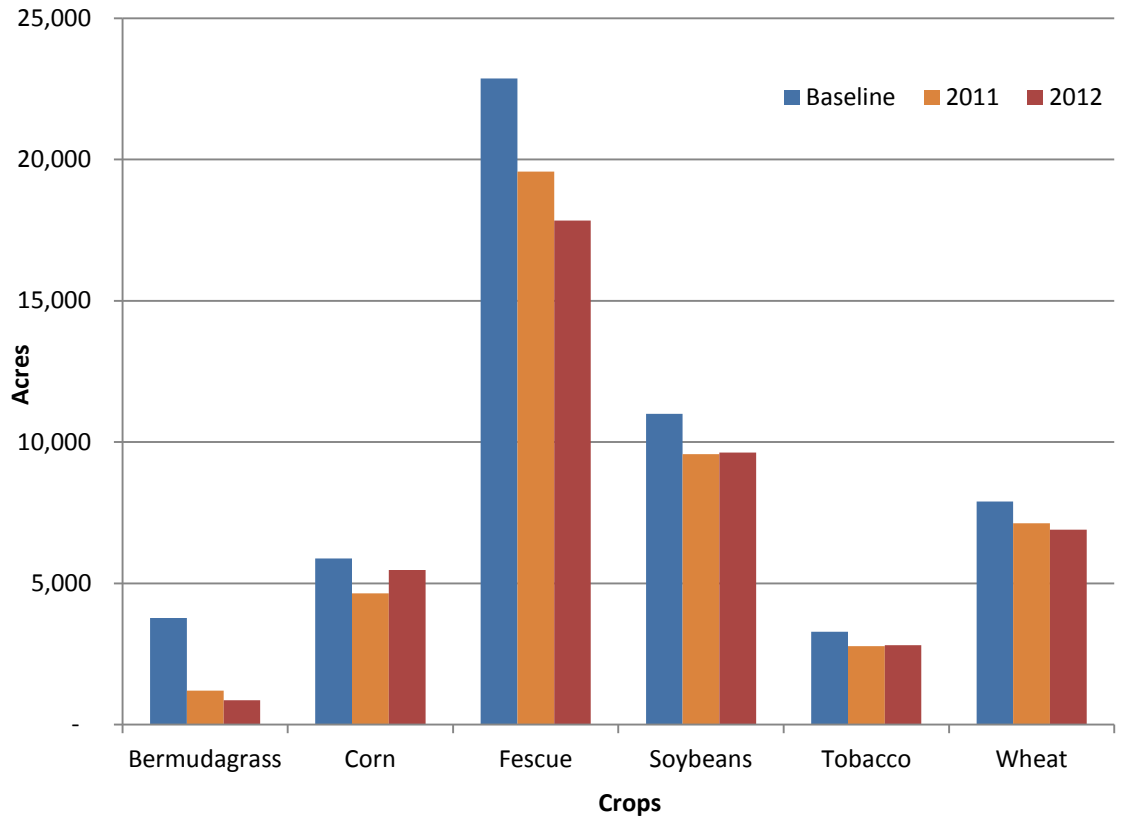
Figure 3. Average annual nitrogen fertilization rate (lb/ac) for agricultural crops for the baseline (2006), 2011, 2012, Falls Lake Watershed



Cropping Shifts

The LACs recalculate the cropland acreage annually by utilizing crop data reported by farmers to the Farm Service Agency. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction. The WOC anticipates that the watershed will see additional crop shifts in upcoming years based on economic changes. A host of factors from individual to global determine crop choices. Crop acreages are expected to fluctuate yearly with market changes. Figure 4 shows crop acres and shifts for CY2012 compared to the baseline. The acres of all major crops have decreased by over 11,000 acres in the watershed since the baseline.

Figure 4. Acreage of Major Crops for the Baseline (2006), 2011, 2012, Falls Lake Watershed



Land Use Change to Development and Cropland Conversion

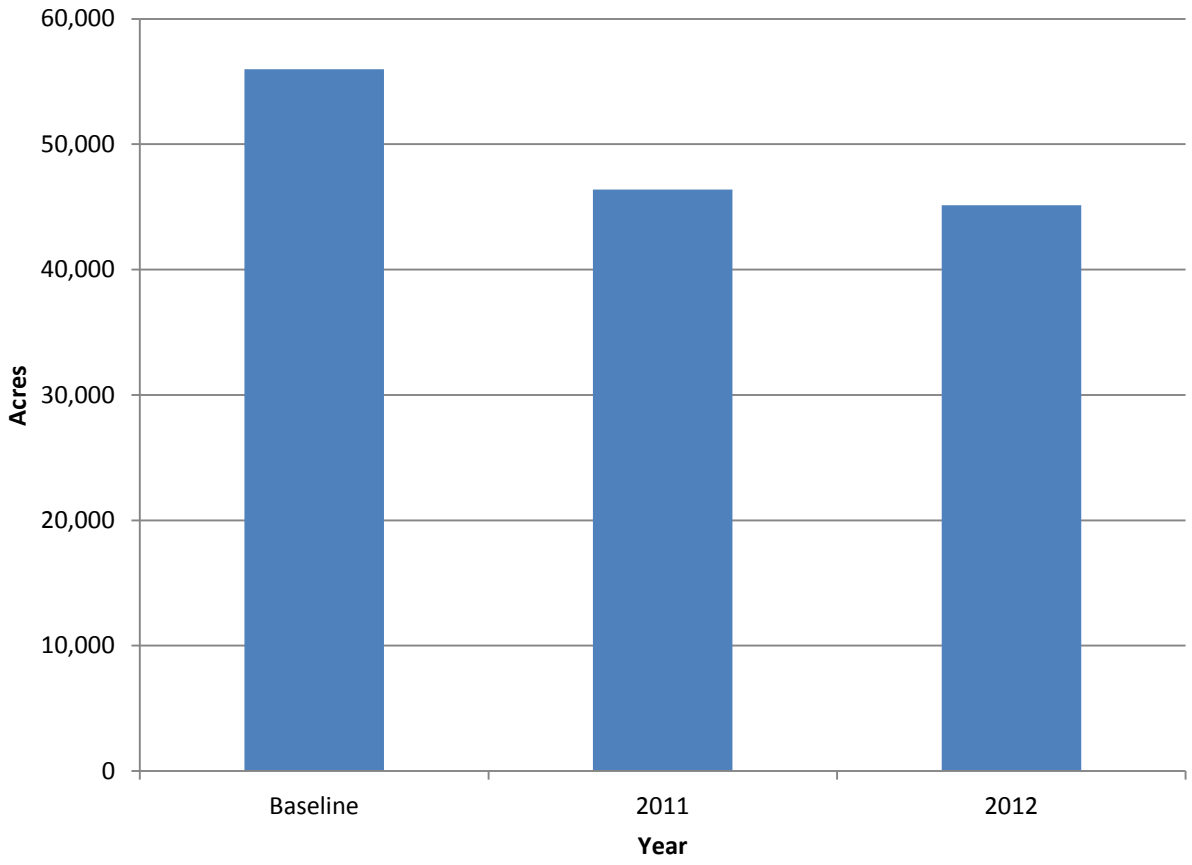
The number of cropland acres fluctuates every year in the Falls Lake Watershed due to cropland conversion and development. Each year, some cropland is either permanently lost to development or converted to grass or trees and likely to be ultimately lost from agricultural production. Data regarding land use change since the baseline is summarized below.

It is estimated that since the 2006 baseline there has been a decrease in crop production of 10,837 acres (19% of total cropland). Of that, 2,560 cropland acres (24% of cropland loss) have been permanently lost to development. Of the 295 cropland acres converted to grass or trees through state and federal cost share programs, almost all (97%) was converted to grass.

The estimates for cropland lost to development come from methodologies developed at the individual county level based on available information and the many and diverse local government reporting

requirements associated with development. Each county uses a different method, but these methods are documented and use the best local information available. The remaining acreage (8,030 acres) could potentially be brought back into crop production. These estimates do not separate the amount of cropland versus pastureland lost; the number reported is agricultural land converted to development.

Figure 5. Total Cropland Acres in the Falls Lake Watershed, Baseline (2006), 2011, 2012



PHOSPHORUS LOSS ACCOUNTING

Phosphorus Indicators for CY2012

The qualitative indicators included in Table 2 show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the watershed. This approach was recommended by the Phosphorus Technical Advisory Committee (PTAC) in 2005 due to the difficulty of developing an aggregate phosphorus tool parallel to the nitrogen NLEW tool and the PTAC reconvened to make minor revisions for the tool's use in the Jordan Lake Watershed in April 2010. This modified approach was approved for use in the Falls Lake Watershed by the Water Quality Committee of the EMC. This report includes phosphorus indicator data for the baseline period (2006) and CY2012. Most of the parameters indicate less risk of phosphorus loss from agricultural management units than in the baseline period.

Factors contributing to the reduced risk of phosphorus loss in the Falls Lake Watershed include:

- Tobacco acres were reduced by over 14%
- Animal waste was reduced by 8% from swine and poultry
- Cropland conversion to other uses.

The soil test phosphorus median number reported for the basin fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus median numbers shown in Table 2 are from agricultural operations and are generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing and the data is reported by the NCDA&CS. The number of samples collected each year varies. The data does not include soil tests that were submitted to private laboratories. The soil test results from the NCDA&CS database represent data from entire counties in the basin, and have not been adjusted to include only those samples collected in the Falls Lake Watershed.

Phosphorus Technical Assistance Committee (PTAC):

The PTAC's overall purpose was to establish a phosphorus accounting method for agriculture in the Tar-Pamlico River Basin. It determined that a defensible, aggregated, county-scale accounting method for estimating phosphorus losses from agricultural lands was not feasible due to "the complexity of phosphorus behavior and transport within a watershed, the lack of suitable data required to adequately quantify the various mechanisms of phosphorus loss and retention within watersheds of the basin, and the problem with not being able to capture agricultural conditions as they existed in 1991." (1991 was the Tar-Pamlico Basin's baseline year.) The PTAC instead developed recommendations for qualitatively tracking relative changes in practices in land use and management related to agricultural activity that either increase or decrease the risk of phosphorus loss from agricultural lands in the basin on an annual basis. This is the approved approach for the Falls Lake Watershed.

Table 2. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Falls Lake Watershed

Parameter	Units	Source	Baseline 2006	CY2011	CY2012	Percent '06-'12 change	CY2012 P Loss Risk +/-
Agricultural land	acres	FSA	55,969	46,387	45,132	-19%	-
Cropland conversion (to grass & trees)	acres	USDA-NRCS & NCACSP	1,527	1,822	1,822	19%	-
CRP / WRP (cumulative)	acres	USDA-NRCS	0	0	0	0%	N/A
Conservation tillage*	acres	USDA-NRCS & NCACSP	26,787	18,142	18,179	-32%	+
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,390	54,418	4%	-
Scavenger crop	acres	LAC	0	0	0	0%	N/A
Tobacco	acres	LAC	3,288	2,782	2,817	-14%	-
Animal waste P	lbs of P/ yr	NC Ag Statistics	586,612	536,009	541,096	-8%	-
Soil test P median	mg/kg	NCDA&CS	77	74	67	-10%	-

** Conservation tillage is being practiced on additional acres but this number only reflects acres under active cost share contracts, not acres where contracts have expired or where farmers have adopted the use of conservation tillage without cost share assistance. It is likely that conservation tillage acres remain high, even after contracts expire, due to farmer satisfaction with the practice after initial implementation.*

Given the key role of phosphorus in the Falls Lake nutrient strategy, the Falls WOC recommends that phosphorus accounting and reporting follow a three-pronged approach:

1. Annual Qualitative Accounting: Conduct annual qualitative assessment of likely trends in agricultural phosphorus loss in the Falls watershed relative to 2006 baseline conditions using the method established by the 2005 PTAC report that added tobacco acreages and removed water control structures.
2. Phosphorus Loss Assessment Tool (PLAT): The PLAT has been developed to assess potential P loss from cropland to water resources. A survey of the Falls Lake watershed counties was conducted in 2010, with the next survey to be conducted in 2015 if funding is available. The results of the 2010 survey demonstrated that the potential for phosphorus loss is very low (< 0.35 lbs/ac/yr) for four of the five counties surveyed. Phosphorus loss in Orange County is rated at the low end of the medium range (> 1 lb/ac/yr). Even with the installation of buffers along all streams and the discontinuation of phosphorus application (fertilizer, biosolids, or animal waste), there would be limited potential for additional phosphorus loss reduction.

3. Improved understanding of agricultural phosphorus management through studies using in-stream monitoring: quantitative in-stream monitoring should be conducted. Such monitoring iscontingent upon the availability of funding and staff resources. An appropriate water quality monitoring design would be a paired-watershed study of subwatersheds with only agricultural land use. This design will allow estimates of phosphorus loading for different management regimes and load reductions after conservation practices have been implemented. However, funding for this study is currently unavailable.

The WOC recommends that no additional management actions be required of agricultural operations in the watershed at this time to comply with the phosphorus goals of the agriculture rule. The WOC will continue to track and report the identified set of qualitative phosphorus indicators to the Division of Water Resources (DWR) annually, and as directed by the rule to the Environmental Management Commission, with the next report to the Commission due in January, 2016 on Stage 1 progress. The WOC expects that BMP implementation may continue to increase throughout the watershed in future years, and notes that BMPs installed for nitrogen, pathogen and sediment control often provide significant phosphorus benefits as well.

PASTURE POINTS ACCOUNTING

The use of a pasture points system was approved by the EMC's Water Quality Committee for use in the Falls Lake Watershed to account for nutrient losses from pasture management units. Pasture activities are tracked by the federal Census of Agriculture conducted by USDA-National Agricultural Statistical Service every five years. The last year for which data was collected was 2007 and the next data set was collected in 2012 and will be available in 2014. Thus, no comparative data is available for pasture accounting in the Falls Lake watershed for this report. As part of the pasture points system, the data used for calculation purposes are acres of pastureland, number of pastured animal units, and livestock densities. The history and process to be used in the 2014 accounting is described below.

A pasture point system subcommittee was formed in 2010 to revisit the accounting method that was developed as mandated by a Session Law of the NC General Assembly for the Tar-Pamlico Basin Agriculture Rule. The subcommittee consisted of individuals representing NCSU, USDA-NRCS, NC DSWC, NC DWQ, NCDA&CS, and Alamance Soil and Water Conservation District. After reviewing available data sources and existing research findings the subcommittee made certain observations and recommendations, which the WOC has accepted.

The pasture point subcommittee found that:

- While the Tar-Pamlico point system was of sound design, it was not practically implementable because it required field-scale assessment, for which human resources were not available. For the purposes of this rule, given the same resources limitations, a county-scale approach to nitrogen loss accounting will be necessary as is done with cropland NLEW accounting.
- Unlike state-based cropland statistics that are developed annually, pasture activities are tracked only by the federal Census of Agriculture conducted by USDA-National Agricultural Statistical Service every five years. This will necessarily limit pasture accounting under this rule to a 5-year cycle. For Falls Lake accounting, the baseline will be 2007 compared to 2012.
- The point system developed for the Tar-Pamlico is fundamentally sound. It assigned nitrogen "point" credit values for BMPs in lieu of percent reductions based on recognition that research data are insufficient to provide the level of confidence required for attributing percent reductions in

nitrogen. Point values reflect best estimates of percent nitrogen reduction but instead bear the "point" label to connote this greater uncertainty. Research has advanced since the Tar-Pamlico system was developed but not sufficiently to depart from this approach.

The crop year 2014 annual report will be the first time that the CY2012 pasture data will be available from the 2012 Census of Agriculture for a CY2007 and CY2012 comparison.

BMP IMPLEMENTATION NOT TRACKED BY NLEW

Not all types of nutrient and sediment-reducing BMPs are tracked by NLEW such as: livestock-related nitrogen and phosphorus reducing BMPs, BMPs that reduce soil and phosphorus loss, and BMPs that do not have enough scientific research to support estimating a nitrogen benefit. The WOC believes it is worthwhile to recognize these practices. Table 3 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period.

Table 3: Nutrient and sediment-reducing installed best management practices, Falls Lake Watershed*

BMP	UNITS	BMPs Installed (CY2006-CY2012)
Critical Area Planting	Acre	2
Composting Facility	Number	1
Cropland Conversion - Grass	Acre	286
Cropland Conversion - Trees	Acre	9
Diversion	Feet	14,378
Dry Stack	Number	5
Fencing (USDA programs)	Feet	33,239
Field Border	Acre	2007
Grassed Waterway	Acre	8,513
Livestock Exclusion	Feet	20,342
Nutrient Management	Acre	398
Pasture Renovation	Acre	326
Stream Crossing	Number	1
Sod-Based Rotation	Acre	6,723
Tillage Management	Acre	18,277
Terraces	feet	3,463
Trough or Tank	number	15
Waste Storage Facility	number	5

**Values represent active contracts in State and Federal cost share programs.*

LOOKING FORWARD

The Falls Lake WOC will continue to improve rule implementation, relying heavily on the local soil and water conservation districts who work directly with farmers to assist with best management practice design and installation.

Because cropping shifts are susceptible to various pressures, the WOC is working with all counties to continue BMP implementation on both cropland and pastureland that provides for a lasting reduction in nitrogen and phosphorus loss in the watershed while monitoring cropping changes.

The committee overseeing the development of NLEW has been reviewing BMP efficiencies credited by the nutrient accounting software. This review is part of the ongoing examination of practices utilized to assess cropland's nutrient losses. Any recommended changes from the NLEW committee will be incorporated into nutrient accounting in future crop years.

Phosphorus accounting and reporting will continue to address qualitative factors and evaluate trends in agricultural phosphorus loss annually. Periodic land use surveys with associated use of PLAT will be conducted every five years contingent upon availability of funding and staff resources. Additionally, understanding of agricultural phosphorus management could be improved through in-stream monitoring contingent upon the availability of funding and staff resources.

A subcommittee of the Falls and Jordan Lake WOCs is working with DWR on issues regarding nutrient offsets that arise from trades involving agricultural land. Also, the WOC feels that additional research is needed on accounting procedures for pasture operations, and supports such research being conducted. Additionally, should readily accessible information become available on biosolids applications to cropland in the watershed, the WOC will consider whether separate accounting for those applications of nutrients is feasible and appropriate.

WOC recognizes the dynamic nature of agricultural business:

- Urban encroachment (i.e., crop selection shifts as fields become smaller)
- Age of farmer (i.e. as retirement approaches farmers may move from row crops to cattle or hay production)
- Changes in the world economies, energy or trade policies
- Changes in government programs (i.e., commodity support or environmental regulations)
- Weather (i.e., long periods of drought or rain)
- Scientific advances in agronomics (i.e., production of new types of crops or improvements in crop sustainability)
- Plant disease or pest problems (i.e., viruses or foreign pests)

Funding is an integral part in the success of this strategy. Without funding for the local Soil and Water Conservation District technicians, the collection of county data for the annual progress reports would fall on the LACs without assistance to compile data and county annual reports. In addition, technicians are needed for BMP installation. Farmers and agency personnel with other responsibilities serve on the LACs in a voluntary capacity. If funding for technician positions is not available, the LACs would have a difficult time meeting the workload requirements. The WOC considers this to be important work, and supports future funding to continue to meet the annual reporting requirements, and the continued efforts to increase BMP implementation. Additionally, the Division of Soil and Water Conservation no longer has the resources available to synthesize county level data for this report, thus putting the development of future annual reports in jeopardy. This reporting is required by the rules, therefore funding is essential for compliance.